

## REMARKS

Applicants thank the Examiner for his thorough review of the present Application. Claims presented for prosecution in this Application are claims 35-59 and claims 63-70, claims 1-34 and 60-62 having been canceled by prior amendment and claim 70 having been newly proposed. Claims 35-68 have been rejected over cited prior art. In view of Applicants' amendment and remarks below, Applicants respectfully request that the present Response be considered and entered, the objections and rejections to the claims be withdrawn, and that the case now be passed to issue.

### Claim Amendments/New Claim

As an initial matter, Applicants note that independent claim 35 has been amended to further define the metal-forming process recited therein. Support for introducing “[applying] at least [a metal-forming process]” may be found, at least, on page 4, lines 20-21 and page 7, lines 7-12 of the PCT application as filed. Support for clarifying that the metal-forming process “exerts a force...to produce [a plastic deformation]” may be found, at least, on page 4, lines 23-25. Moreover, support for clarifying that this force is exerted “onto at least one of said front face and said rear face” may be found, at least, on page 4, lines 25-28 and FIGS. 14-15.

Claim 59 has also been amended to more clearly define the plastic deformation of the plate and tube as a result of the press-fit. Support for introducing “at least [along said channel]” may be found, at least, on page 4, lines 22-28. Support for clarifying that “[the plastic deformation is] conferring an oval cross-section to said channel and said tube” may be found, at least, on page 4, lines 9-10; page 6, lines 16-24; page 11, lines 23-25 and 29-31; page 14, lines 28-30; page 16 lines 14-18; and FIGS. 10, 13 and 15.

Claim 70 has been newly added to more clearly define the scope of protection owed Applicants. Support for a “blast furnace stave” may be found, at least, one page 1, lines 3-4 and page 10, lines 7-10.

The Examiner has objected to claims 60-62 under 37 CFR 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim. Pursuant to Examiner’s suggestion, and solely in an effort to advance prosecution, Applicants have canceled claims 60-62.

#### **The 35 U.S.C. § 102(b) Rejection of Claims 35-41, 50 and 53-68 Over German ‘998**

The Examiner has rejected claims 35-41, 50 and 53-68 as being anticipated by German Patent No. DE 33 13 998 (German ‘998). Applicants traverse this rejection and respectfully assert that German ‘998 does not disclose or render obvious each and every element of, at least, independent claims 35 and 59.

With respect to independent claim 35, as currently amended, Applicants again stress to the Examiner that the term “*metal-forming*,” according to its ordinary meaning, relates to a process that modifies the shape of the metallic object being processed by deforming the metal. Claim 35 thus inherently requires that at least some part of the metallic plate body is deformed into a specific shape (geometry) different from its original shape.

The Examiner has correctly noticed that German ‘998 teaches manufacturing of a cooling plate including shrinkage-fitting of a steel tube in a cast iron plate body by heating the plate body and cooling the tube prior to insertion of the latter into the former (page 9, lines 31-34).

Shrinkage-fitting makes use of thermal expansion and/or thermal contraction, which, for metals at least, is generally isometric (of equal dimension in all directions)

and, more importantly, perfectly reversible. Therefore, after a shrinkage-fit has been applied in accordance with German '998, the shape (geometry) of the cast iron plate is identical to its initial shape (geometry).

Applicants respectfully submit that shrinkage-fitting is not "a metal forming process," neither within the generally accepted meaning of the term, nor within the context of the present application. While the Examiner may be correct in stating that shrinkage-fitting "meets the definition of a metallurgical process," it is not a "metal forming" (emphasis added) process that modifies the initial shape of the plate into a different target shape. Indeed, the plate according to German '998 has the same shape prior to, and after, shrinkage-fitting. Accordingly, based on the proper interpretation of the expression "*metal-forming*," and since the process taught by German '998 does not involve any change in shape (geometry) of the cast iron plate, German '998 fails to teach "*applying at least a metal-forming process*," as explicitly recited in independent claim 35 of the present invention.

Moreover, Applicants respectfully submit that independent claim 35 now explicitly recites the step of, "achieving a press fit of said tube within said channel by applying at least a metal-forming process *that exerts a force onto at least one of said front face and said rear face to produce a plastic deformation* of said metallic plate body." (Emphasis added). In stark contrast to the present invention, the shrinkage-fitting disclosed in German '998 is not a process that "exerts a force onto at least one of said front face and said rear face" of the plate, as now required by independent claim 35. Indeed, as will be readily appreciated by one of ordinary skill in the art, the only forces present in the shrinkage-fitting of German '998 are *internal* to the plate, along an inner periphery of the machined holes.

Accordingly, as German '998 does not disclose or render obvious each and every element of, at least, independent claim 35, Applicants respectfully request that the

instant rejection be withdrawn and that claim 35, and claims 36-58 which depend therefrom, be allowed.

With respect to independent claim 59, Applicants have amended independent claim 59 to more fully and clearly define the invention and the scope of protection due Applicants. In particular, independent 59 now recites a cooling plate for a metallurgical furnace comprising, *inter alia*, “a press fit between said metallic plate body and said at least one metallic tube, and with a plastic deformation of said metallic plate body at least along said channel, said plastic deformation providing a pre-dominant contribution to said press fit *and conferring an oval cross-section to said channel and said tube.*” (Emphasis added).

As discussed above, shrinkage-fitting, such as that employed in German ‘998, makes use of thermal expansion and/or thermal contraction, which, for metals at least, is generally isometric, i.e., of equal dimension in all directions. Therefore, after a shrinkage-fit has been applied in accordance with German ‘998, the shape (geometry) of the cast iron plate and the tubes are identical to their original shapes. That is, the machined holes and the tubes, which are originally cylindrical in nature and have a circular cross-section, will remain cylindrical in nature and maintain their circular cross-section even after shrinkage-fitting is applied. In stark contrast to German ‘998, the present invention discloses the exertion of a force on a front or rear face of the plate to create a press fit between the plate and the metallic tube causes the channel and the tube to deform, thereby “conferring an oval cross-section to said channel and said tube.”

Consequently, German ‘998 fails to expressly or inherently disclose the conferring of “an oval cross-section to said channel and tube” as a result of a press fit between the plate and the tube, as explicitly recited in independent claim 59.

Accordingly, Applicants respectfully submit that since German '998 fails to disclose or render obvious each and every element of, at least, independent claim 59, the Examiner's rejection under 35 U.S.C. § 102(b) is improper. Claims 63-69, which depend respectively therefrom, are urged allowable for at least these reasons.

**The 35 U.S.C. § 103(a) Rejection of Claims 35-68 Over Hornschemeyer in View of either GB '655 or JP '661**

The Examiner has rejected claims 35-68 as being unpatentable over Hornschemeyer in view of either GB '655 or JP '661.

As is understood, “[i]n determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious.” MPEP § 2141.02. That is, “[a] prior art reference must be considered in its entirety, i.e., as a whole, *including portions that would lead away from the claimed invention.*” Id. (Emphasis added).

Applicants respectfully submit that there is no express teaching or suggestion in either the GB '655, JP '661 or German '998 reference to modify the device of Hornschemeyer as proposed by the Examiner to arrive at the present invention. Moreover, Applicants do not believe that one of ordinary skill in the art would combine the cited prior art references in the manner proposed by the examiner, absent improper and impermissible hindsight reconstruction of the claimed invention.

Applicants respectfully submit that the Examiner's alleged motivation to combine the teachings of Hornschemeyer with those of either GB '655 or JP '661 is improper. The Examiner has alleged that Hornschemeyer teaches all aspects of the present invention “except the specific step of forming cooling holes through the insertion of cooling tubes within the machined holes prior to deforming through rolling of the plate.” The Examiner maintains, however, that the motivation to combine either

GB '655 or JP '661 with Hornschemeyer can be found in paragraph [0020] (not paragraph [0023]) of Hornschemeyer, which provides, *inter alia*, that "the passages (7) may be made by 'using all known methods'."

Applicants respectfully submit, however, that the Examiner's interpretation of this portion of Hornschemeyer regarding the alleged motivation to combine is erroneous. In particular, the portion of Hornschemeyer that provides that channels may be made by all known methods relates to methods suitable for providing integrated channels, i.e., methods for forming channels in the plate body. An accurate translation of paragraph [0020] of Hornschemeyer reads:

"A preferred embodiment of the invention is seen in the features of patent claim 6. Herein, channels with a circular cross-section are introduced in the raw block or in the plate body before the final thickness is reached. The creation (in German: "Herstellung") of the channels can be achieved using all known method steps. When the raw block or the plate body is deformed into the final thickness, the cross-section of the channels is also deformed, in particular [into] oval or oblong round [shape]. These cross-sections contribute to an improved thermal conductivity." (Explanations and emphasis added.)

Claim 6 of Hornschemeyer, which finds support in paragraph [0020], depends from claim 5. The last clause of claim 5 reads:

"[...] wherein, before the final thickness (D2) is reached, coolant channels (3) are created [in German: hergestellt] in the raw block (6) or in the plate body (2)."

Moreover, in claims 8 and 9 which depend on any one of claims 5-7, Hornschemeyer makes reference to two different methods for creating the channels in the plate/block, namely mechanical deep drilling of the plate body and initially creating hollow channels during casting of the raw block.

Furthermore, paragraph [0033] of Hornschemeyer, which refers to the initial shape of FIG.2 (uppermost cross-section illustrated) provides, *inter alia*, "...[c]hannels (7) are mechanically deep drilled into the raw block (6)."

Accordingly, in view of the passages cited above, and upon proper consideration of the whole content of Hornschemeyer, it is unquestionable that the "known methods" Hörnschemeyer mentions are such methods for creating a hollow channel inside a solid body. In stark contrast to the present invention, Hornschemeyer does not contemplate the insertion of cooling tubes within the holes or channels after the holes or channels are formed, but only the forming of the actual channels inside a solid plate.

Conversely, inserting a tube requires, as a necessary precondition, preliminary presence of such hollow channel. Thus, inserting a tube in itself cannot reasonably be seen to constitute a "known method" that *creates* a channel inside the solid plate body or solid raw block in accordance with Hörnschemeyer.

Moreover, even though GB '655 and JP '661 relate to providing coolant passages in a heat exchanger, neither of these references relate to a method suitable for providing channels integrally inside the plate body. GB '655 and JP '661 both merely relate to externally fixing a tube onto a heat exchanger plate. Therefore, the statement in Hornschemeyer quoted by the Examiner could not reasonably motivate one of ordinary skill in the art to consider either GB '655 or JP '661. Moreover, there is no need whatsoever to additionally provide coolant tubes within the integrally formed coolant channels proposed by Hornschemeyer, since the integral channels according to Hornschemeyer already provide coolant passages.

Accordingly, Applicants respectfully submit that the instant § 103 rejection amounts to impermissible hindsight reconstruction of Applicants' invention in view of Applicants' own specification. That is, Applicants respectfully submit that the Examiner, in his rejection, has impermissibly used the present invention as a road map through the prior art to find the claimed elements. This type of hindsight reconstruction of Applicants' invention is not permitted.

In view of the above, Applicants respectfully submit that the Examiner's alleged motivation to combine the cited references is improper and, therefore, respectfully request that the instant rejection of the claims be withdrawn.

Applicants additionally submit that not only does Hornschemeyer lack any motivation to combine the cited references, but Hornschemeyer clearly teaches away from the claimed invention, for at least the reasons cited in the previous Response to Office Action. Contrary to the Examiner's allegation, Hornschemeyer does not merely teach "*only the undesirability of employing cast iron tubes.*" (Page 4 of Office Action) (Emphasis added).

Applicants respectfully submit that the Examiner appears to have misunderstood the translated passage contained in Applicants' prior Response, which may not be entirely clear due to literal translation. Accordingly, Applicants reproduce a more accurate translation (with explanation) of paragraph [0004] of Hornschemeyer as follows:

*"Cooling plates are known in which coolant channels are formed by tubes [that are] cast into [the] cast iron [of the plate, NB: Hörnschemeyer suggests a copper plate]. These cooling plates have low heat removal capability due to the low thermal conductivity of cast iron and due to the resistance between the cooling tubes and the plate body, caused by an oxide layer or an air-gap."* (Linguistic clarification added in square brackets and emphasis added by underlining).

It follows from the first two sentences of subsequent paragraph [0005] that “cast iron” in paragraph [0004] refers to the material of the plate, not the tubes.

From the quoted passage of paragraph [0004] it is therefore clear to one of ordinary skill in the art that the resistance caused by an *intermediate* oxide layer or an air-gap between plate and tube is completely independent of the material of the tube.

Therefore, Hörnschemeyer clearly teaches away from, and in fact discourages, inserting any kind of tube into channels provided in the plate body. Paragraph [0008] defines the object to be achieved by the invention of Hornschemeyer, i.e., “...*a qualitatively improved cooling plate with increased cooling effect and high efficiency...*” (Emphasis added).

In sum, Hörnschemeyer undeniably discourages, i.e. teaches away from providing any kind of additional coolant tube within the coolant passages that are created inside the plate by any *known method for producing a hollow channel in the plate body* (e.g. deep drilling of the plate body or during initial casting of the raw block) because this obviously runs counter the underlying objective of increasing cooling effect and [thermal] efficiency.

In addition, on page 4 of the Final Office Action, the Examiner alleges that, “Hornschemeyer in its broadest reasonable embodiment specifically includes the use of coolant channel construction steps as recited by each of GB ‘655 and JP ‘661,” and states that “a reference is relevant for all of the embodiments it teaches, not only its preferred embodiments, but even non-preferred and undesirable embodiments.” That is, the Examiner has alleged that Hornschemeyer would “specifically include” tube insertion as an “undesirable embodiment,” and has relied on this allegation as a basis for his rejection.

As noted above, Hornschemeyer specifically states that coolant tubes cause additional heat resistance (see paragraph [0004]). As such, any inclusion of cooling tubes would run counter to the clearly stated objective of Hornschemeyer, i.e., to provide a cooling plate with increased cooling effect and high efficiency. For this reason alone, the content of paragraph [0004] cannot form part of any “undesirable embodiment.” Moreover, the Examiner’s assertion is a *contradictio de terminis*, i.e., if Hornschemeyer were to include the “use of coolant channels construction as recited by GB ‘655 or JP ‘661,” as alleged by the Examiner, then the Examiner should have substantiated a lack of novelty rejection under 35 U.S.C. § 102.

Finally, Applicant respectfully submits that the Examiner’s standard for assessing the prior art is erroneous. That is, it seems to Applicants that the Examiner has applied the standard for claim interpretation for claims under examination (“broadest reasonable interpretation” MPEP 2181) to interpretation of a prior art disclosure. Such an approach would seemingly render a rightful rebuttal under MPEP 2141.02 and MPEP 2145(X)(D) (“teach away”) simply impossible. Following the Examiner’s approach, any passage that clearly teaches away from a combination, such as that found in Hornschemeyer, could be interpreted as forming part of an “undesirable embodiment” of the disclosure and thus render such rebuttal impossible. Clearly, such an approach as that taken by the Examiner cannot be proper, as it would be in direct contravention to the MPEP.

In view of the above, Applicants respectfully submit that the Examiner’s 35 U.S.C. § 103(a) rejection of claims 35-59 and 63-68 is improper and should be withdrawn.

### **New Claim 70**

Applicants have proposed new independent claim 70 in an effort to more clearly define the scope of protection owed Applicants.

Independent claim 70 recites:

"A blast furnace stave manufactured by a process comprising the steps of:

providing a metallic plate body with a front face, a rear face and at least one channel extending through said metallic plate body beneath said front face;

inserting, with radial clearance, a metallic tube into said channel so that both tube ends protrude out of said channel; and

achieving a press fit of said tube within said channel by applying at least a metal-forming process *that exerts a force onto at least one of said front face and said rear face* to produce a plastic deformation of said metallic plate body." (Emphasis added).

It is not seen that any of the cited prior art references, either alone or in combination, disclose a blast stave furnace manufactured, *inter alia*, by applying a metal forming process that exerts a force onto one of the front face and rear face of the metallic plate body to produce a plastic deformation of the metallic plate body. Importantly, the metallurgical structure of the plate body is improved by this metal forming process. In particular, as stated on page 6, lines 19-21 of the application as filed, the plate body that has been subjected to the metal-forming process has improved metallurgical properties, e.g., a thermally more conductive microstructure. In addition, quantitative crystallography can be used to analyze the microstructure and determine the degree of strain to which the plate body has been subjected during the metal-forming process.

For this reason alone, the blast stave furnace of claim 70 is allowable over the cited references, either alone or in combination.

## CONCLUSION

In view of the amendments and remarks above, and in connection with the Request for Continued Examination submitted herewith, it is respectfully submitted that claims 35-59 and 63-70 are now allowable, and an early action to that effect is earnestly solicited.

The Examiner is invited to contact the undersigned at the number below to expedite resolution of any issues the Examiner may consider to remain unresolved. In particular, should a Notice of Allowance not be forthcoming, the Examiner is requested to phone the undersigned for a telephonic interview, an Examiner's amendment, or the like, while the outstanding issues are fresh in the mind of the Examiner.

Authorization is hereby given to charge our Deposit Account No. 13-0235 for the Request for Continued Examination and the accompanying Two-Month Extension of Time. It is believed that no other fees or deficiencies in fees are owed. However, authorization is hereby given to charge our Deposit Account No. 13-0235 in the event any additional fees or deficiencies in fees are owed.

Respectfully submitted,

By /Michael D. Cartona/  
Michael D. Cartona  
Attorney for Applicants  
Registration No. 61,960

Customer No. 35301  
McCORMICK, PAULDING & HUBER LLP  
CityPlace II, 185 Asylum Street  
Hartford, Connecticut 06103-4102  
Tel. (860) 549-5290  
Fax. (413) 736-4543